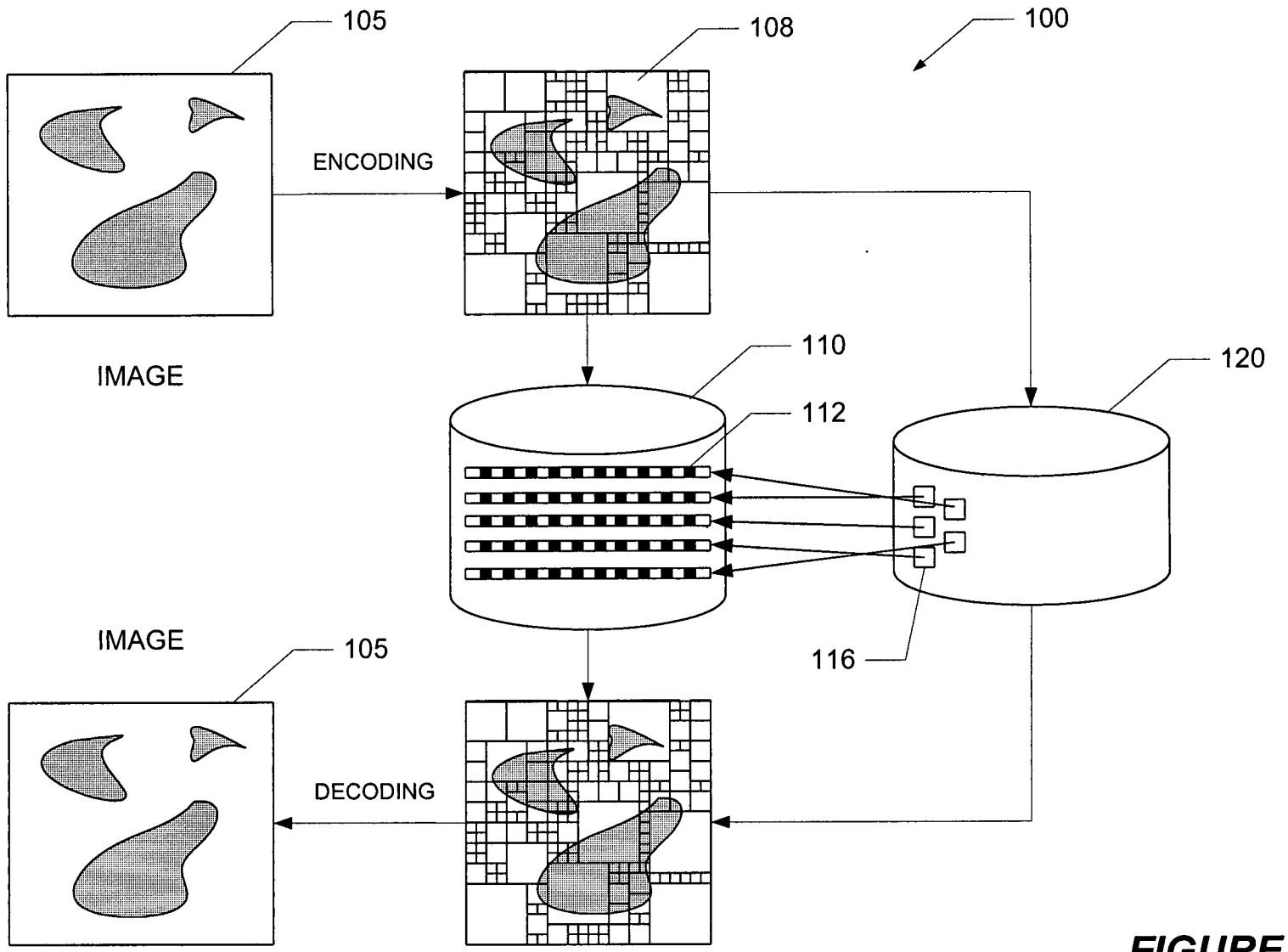
105
108
100
ENCODING
IMAGE
110
120
112
116
IMAGE
105
DECODING

FIGURE 1

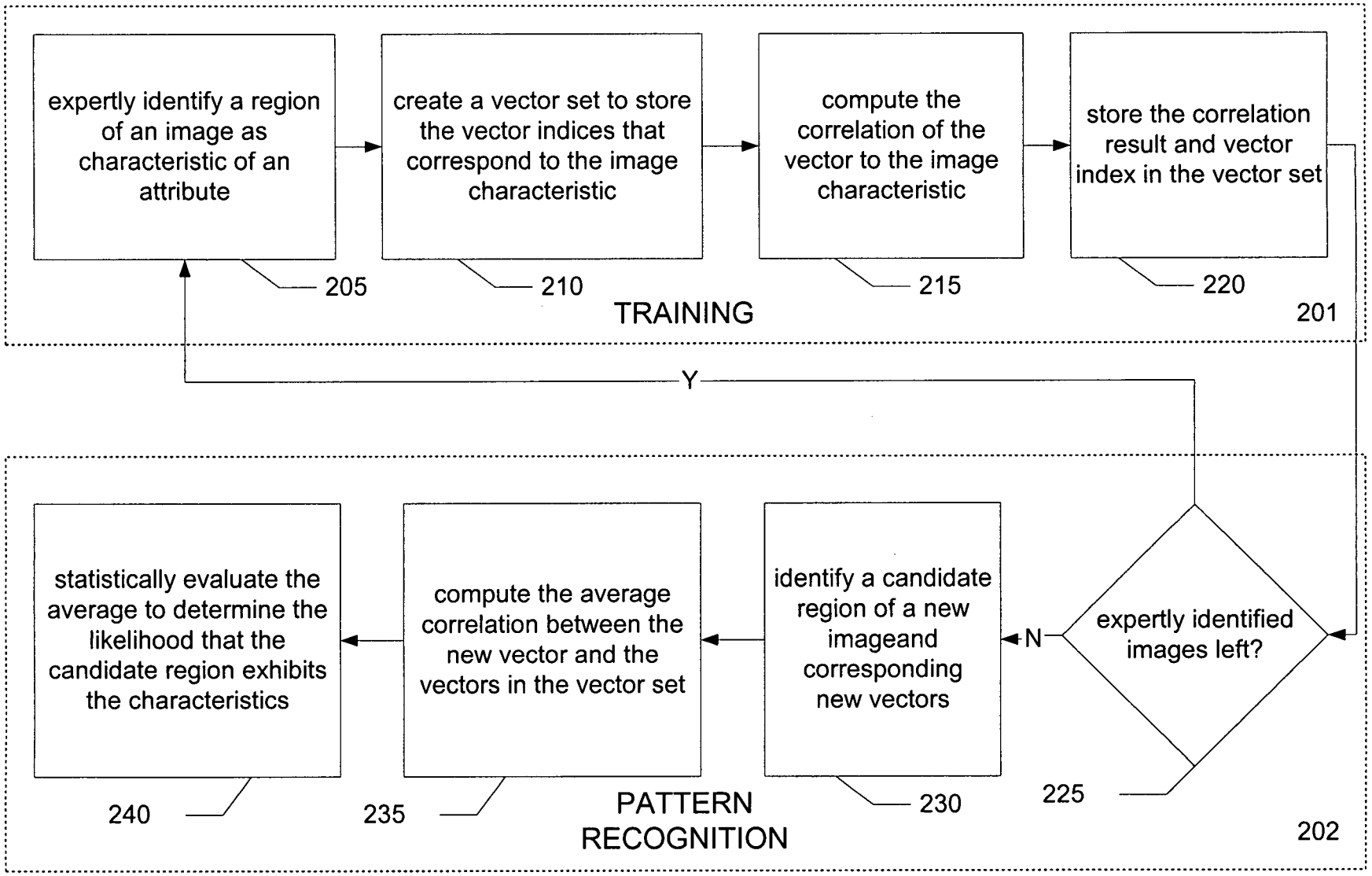
expertly identify a region of an image as characteristic of an attribute
create a vector set to store the vector indices that correspond to the image characteristic
compute the correlation of the vector to the image characteristic
store the correlation result and vector index in the vector set
205
210
215
220
TRAINING
201
Y
statistically evaluate the average to determine the likelihood that the candidate region exhibits the characteristics
compute the average correlation between the new vector and the vectors in the vector set
identify a candidate region of a new imageand corresponding new vectors
expertly identified images left?
N
240
235
230
225
PATTERN RECOGNITION
202

FIGURE 2

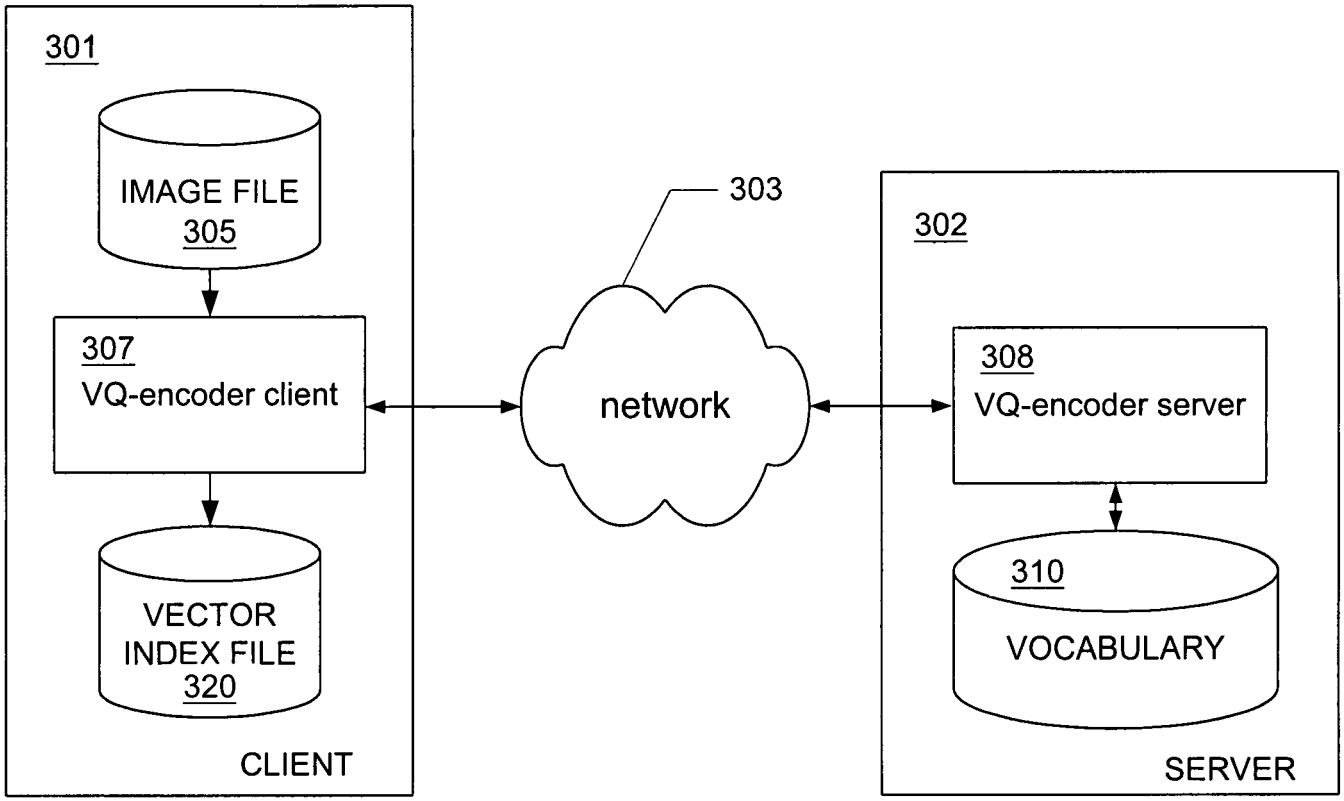
301
IMAGE FILE
305
307
VQ-encoder client
VECTOR
INDEX FILE
320
CLIENT
303
network
302
308
VQ-encoder server
310
VOCABULARY
SERVER

FIGURE 3

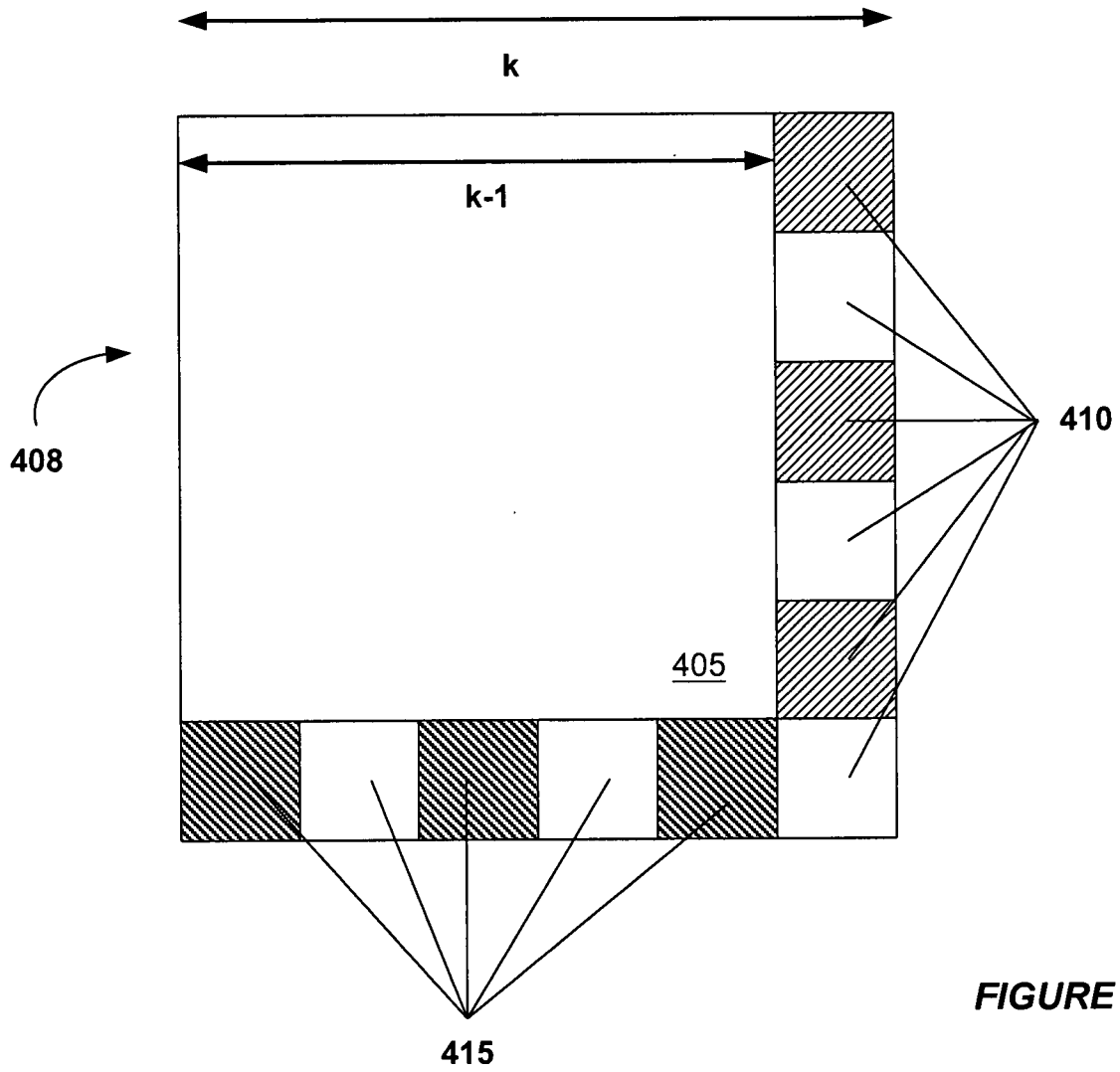

FIGURE 4

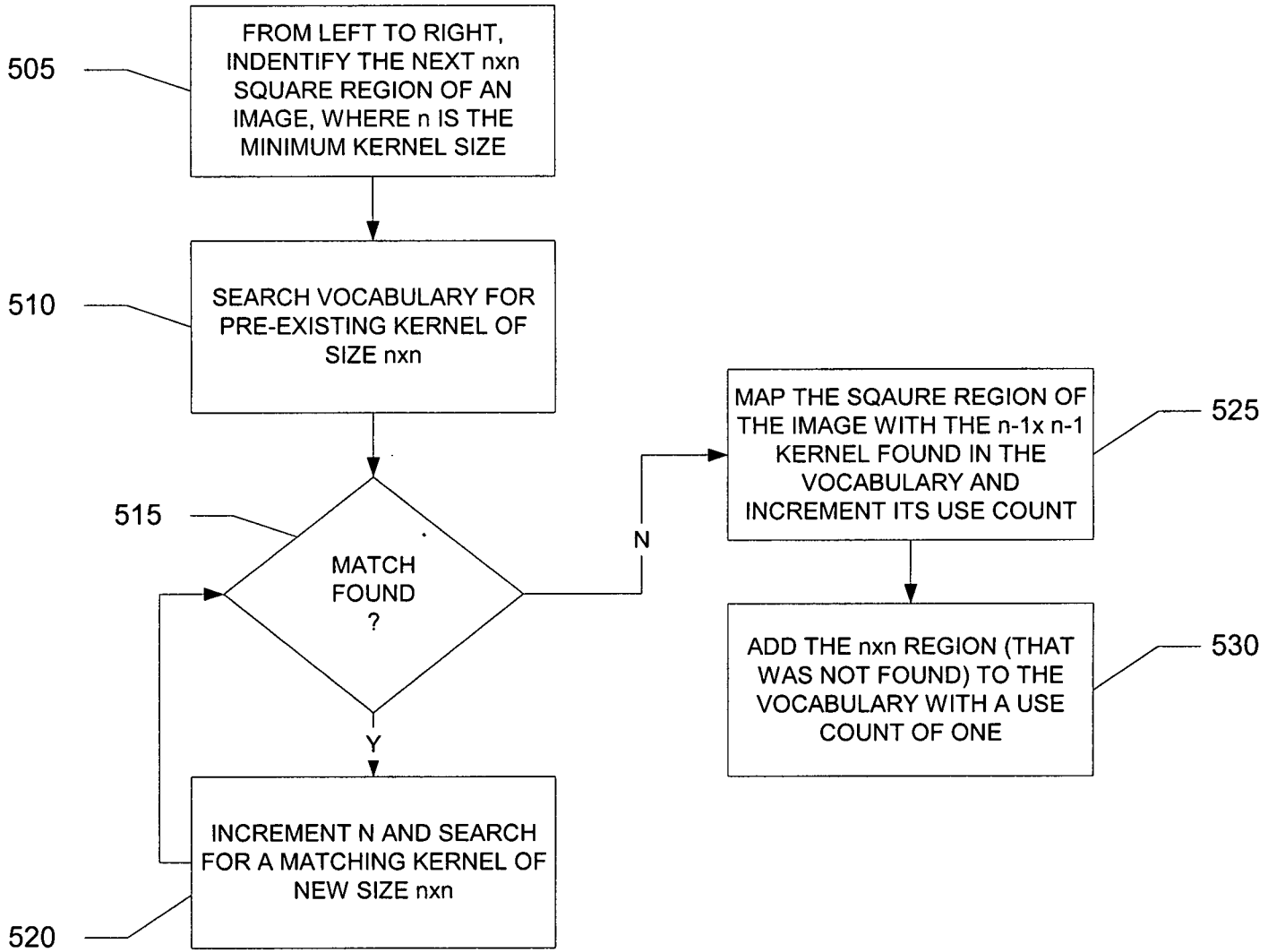
505
FROM LEFT TO RIGHT, INDENTIFY THE NEXT nxn SQUARE REGION OF AN IMAGE, WHERE n IS THE MINIMUM KERNEL SIZE
510
SEARCH VOCABULARY FOR PRE-EXISTING KERNEL OF SIZE nxn
515
MATCH FOUND ?
N
Y
525
MAP THE SQAURE REGION OF THE IMAGE WITH THE n-1x n-1 KERNEL FOUND IN THE VOCABULARY AND INCREMENT ITS USE COUNT
530
ADD THE nxn REGION (THAT WAS NOT FOUND) TO THE VOCABULARY WITH A USE COUNT OF ONE
520
INCREMENT N AND SEARCH FOR A MATCHING KERNEL OF NEW SIZE nxn

FIGURE 5

slide	JP2 KB	width	height	size Mp	size MB	comp	%tissue
vs439_20xn	230,818	39,230	33,546	1,255	3,765	16.7	70%
vs440_20xn	296,146	48,738	34,134	1,587	4,760	16.5	60%
vs441_20xn	215,070	37,339	34,369	1,224	3,672	17.5	70%
vs442_20xn	369,609	52,631	37,961	1,905	5,716	15.8	65%
vs443_20xn	118,670	29,667	26,488	749	2,248	19.4	60%
vs482_20xn	270,844	52,619	37,461	1,880	5,640	21.3	45%
vs483_20xn	149,627	35,429	31,703	1,071	3,214	22.0	45%
vs484_20xn	303,685	43,034	37,840	1,553	4,659	15.7	75%
vs485_20xn	278,714	49,734	39,962	1,895	5,686	20.9	45%
vs486_20xn	297,861	52,570	35,451	1,777	5,332	18.3	55%

JP2 KB - size of JPEG2000 file in Kbytes
Width - width of image in pixels
Height - height of image in pixels
Size Mp - size of image in Mpixels
Size Mb - size of image in Mbytes
Comp - compression ratio (JP2 vs. image data)
%tissue - approximate %tissue on slide (vs. glass)

Table 0. Sample table of liver slides used for study

FIGURE 6

slide	VIF KB	comp	#vectors	ave vect	VCB MB	idx MB	#vectors	ave vect	idx time	enc time	tot time
vs439_20xn	121,702	31.7	31,148,155	6.5	818	520	59,181,494	3.2	0:00:00	0:09:23	0:09:23
vs440_20xn	128,042	38.1	32,770,657	7.1	964	559	68,244,628	3.4	0:17:25	0:10:58	0:28:23
vs441_20xn	110,050	34.2	28,165,796	6.7	1,069	586	75,800,102	3.3	0:18:49	0:10:09	0:28:58
vs442_20xn	153,772	38.1	39,355,871	7.1	1,220	625	86,035,088	3.4	0:19:50	0:12:56	0:32:46
vs443_20xn	54,584	42.2	13,970,124	7.5	1,281	640	89,555,559	3.4	0:21:16	0:09:24	0:30:40
vs483_20xn	24,997	131.6	6,397,753	13.2	2,876	944	168,756,512	4.9	0:38:40	0:21:15	0:59:55
vs484_20xn	45,119	105.7	11,547,703	11.8	2,889	944	169,092,117	4.9	0:38:50	0:22:51	1:01:41
vs485_20xn	42,609	136.7	10,905,185	13.5	2,906	945	169,378,378	4.9	0:39:00	0:24:04	1:03:04
vs486_20xn	42,270	129.2	10,818,519	13.1	2,921	945	169,633,289	5.0	0:39:12	0:23:54	1:03:06
vs487_20xn	18,242	168.7	4,668,846	15.0	2,939	946	169,731,334	5.0	0:39:22	0:21:50	1:01:12

Slide - name of slide
VIF KB - size of vector index file in Kbytes
Comp - compression ratio (VIF vs. image data)
#vectors - number of vectors in vector index file (number of kernels found in image)
ave vect - average size of vectors in vector index file (average size of kernels)
VCB MB - size of vocabulary file after processing in Mbytes
Idx MB - size of memory-resident index after processing in Mbytes
#vectors - number of vectors in vocabulary
ave vect - average size of vectors in vocabulary
idx time - time required to load vocabulary index
enc time - time required to encode image (after index loaded)
tot time - total time required for processing (index time plus encode time)

FIGURE 7

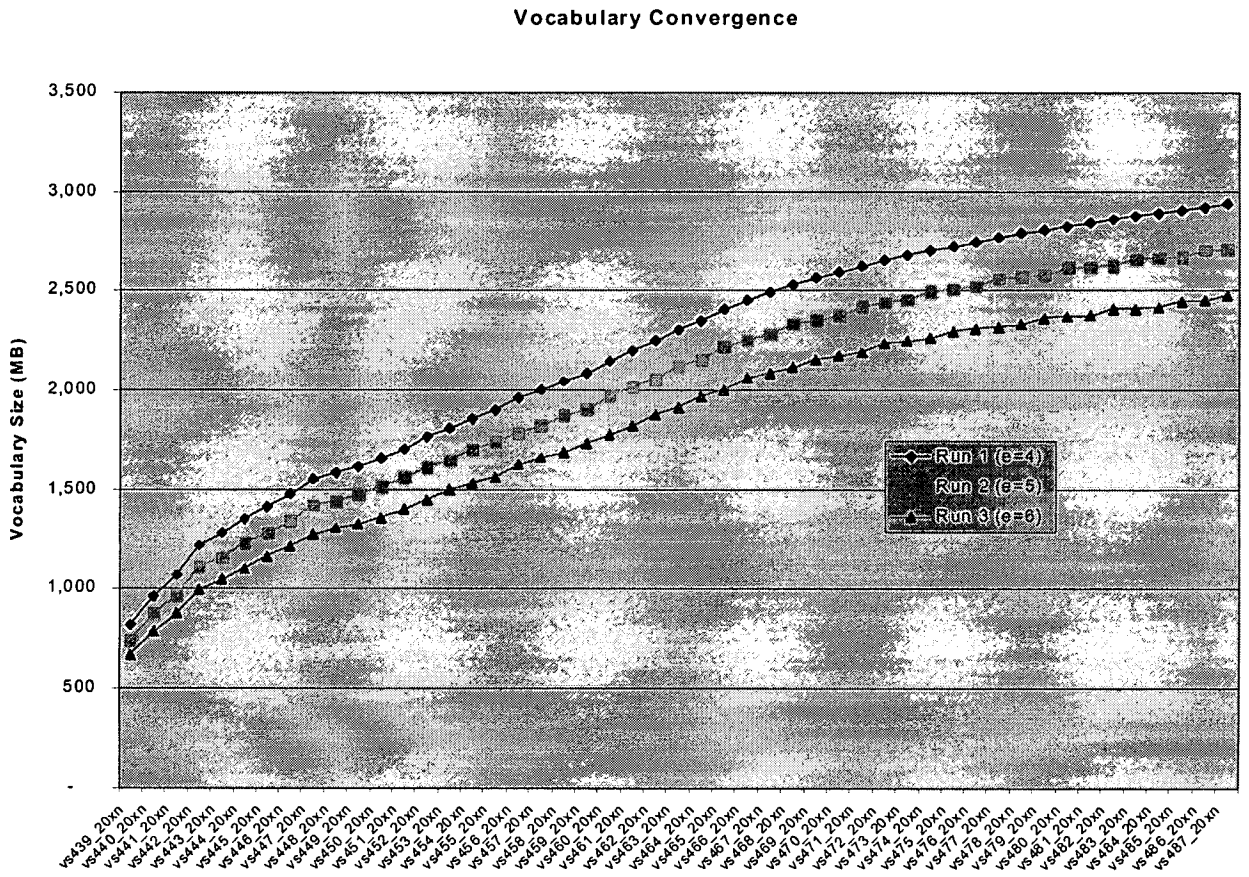
Vocabulary Convergence
Vocabulary Size (MB)
3,500
3,000
2,500
2,000
1,500
1,000
500
-
Run 1 (e=4)
Run 2 (e=5)
Run 3 (e=6)

FIGURE 8

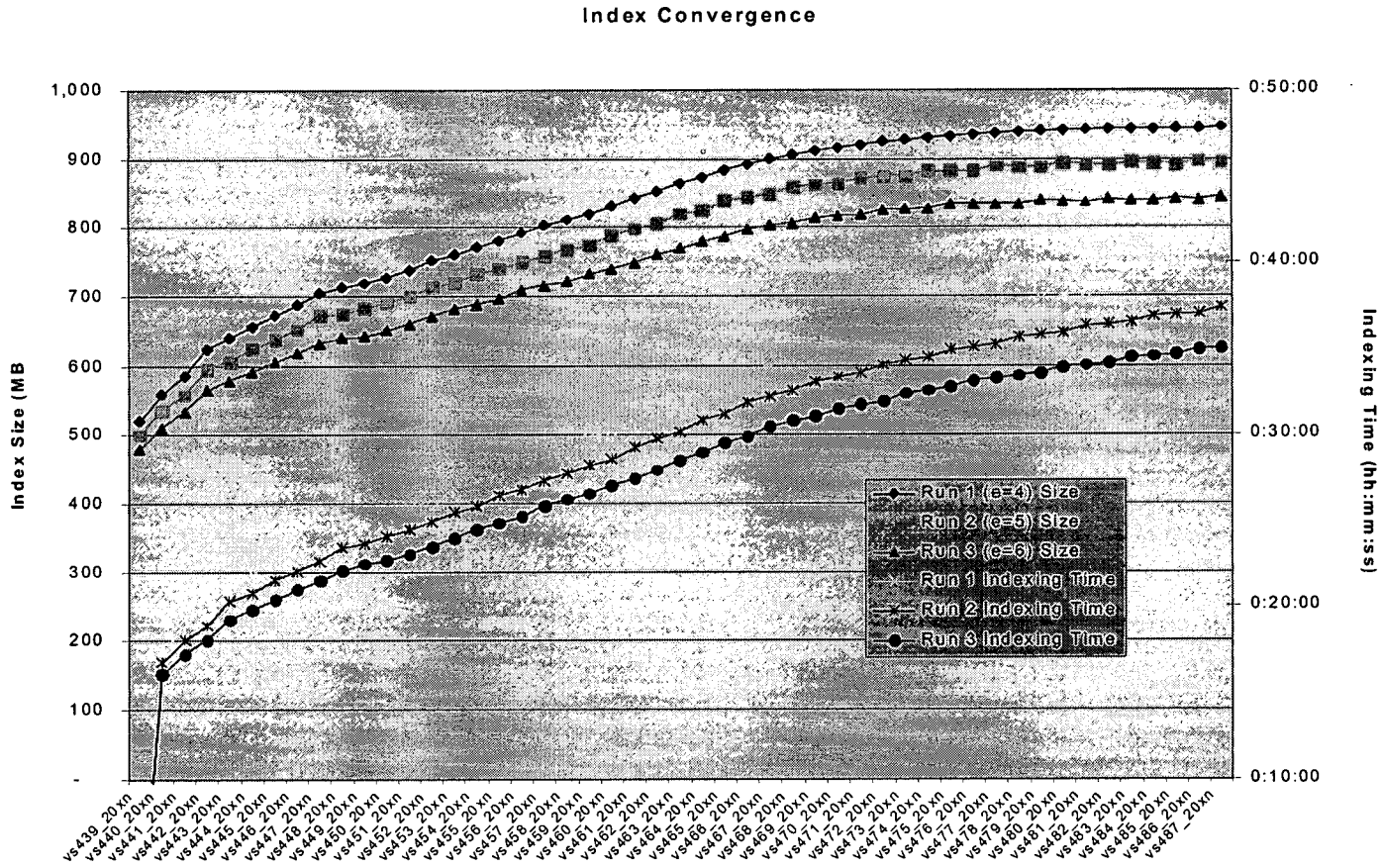
Index Convergence
Index Size (MB
Indexing Time (hh:mm:ss)
1,000
900
800
700
600
500
400
300
200
100
-
0:50:00
0:40:00
0:30:00
0:20:00
0:10:00
Run 1 (e=4) Size
Run 2 (e=5) Size
Run 3 (e=6) Size
Run 1 Indexing Time
Run 2 Indexing Time
Run 3 Indexing Time

FIGURE 9

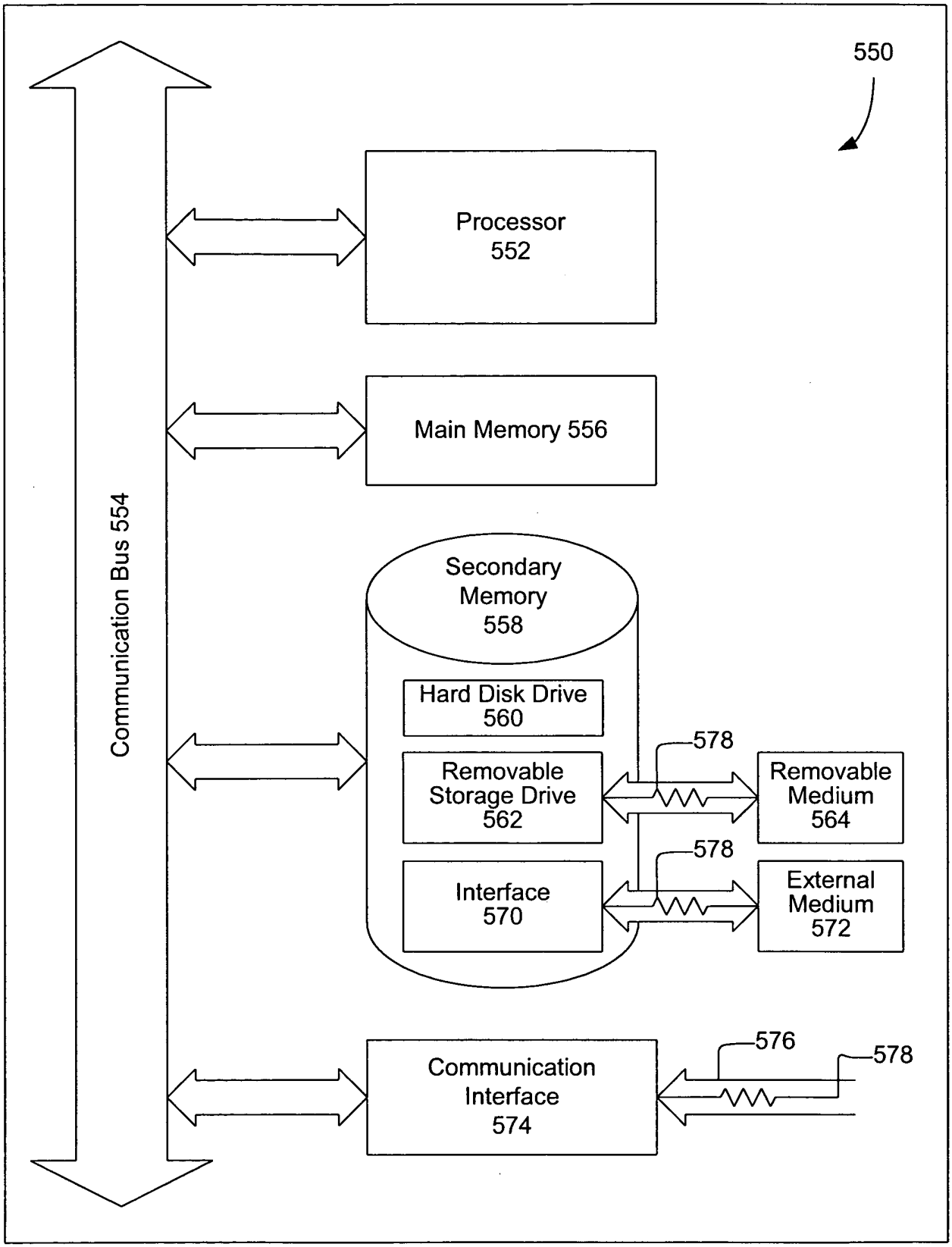
550
Processor
552
Main Memory 556
Communication Bus 554
Secondary
Memory
558
Hard Disk Drive
560
Removable
Storage Drive
562
578
Removable
Medium
564
578
Interface
570
External
Medium
572
Communication
Interface
574
576
578

FIG. 10